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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.	
09/992,980	11/06/2001	Ja-Hum Ku	SAM-0266	7596	
7590	12/16/2003		EXAMINER		
Steven M. Mills MILLS & ONELLO LLP Suite 605 Eleven Beacon Street Boston, MA 02108			LEE, CALVIN		
			ART UNIT		PAPER NUMBER
			2825		
DATE MAILED: 12/16/2003					

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/992,980

Applicant(s)

KU ET AL.

Examiner

Lee Calvin

Art Unit

2825

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 November 2003 (RCE and Amendment B).
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3,4 and 9-12 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3,4 and 9-12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 November 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

OFFICE ACTION

Response to Amendment

1. The amendment of claim 1, the cancellation of claims 2 and 5-8, and the addition of claims 9-12, filed on November 24, 2003, are acknowledged.

Claim Rejections - 35 U.S.C. § 102

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made

3. Claims 1, 3-4, and 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Tanabe et al* (US 6,197,702) in view of *Rha* (US 6,284,634).

a) *Tanabe et al* discloses a method of forming a metal gate electrode, comprising of:

- forming the metal gate electrode comprised of a silicon layer **10**, a WN barrier layer **11**, a W layer **12**, and a SiN capping layer **13** [Fig. 8 and col. 13]
- performing a selective oxidation process in a chamber to the metal gate electrode in a hydrogen-rich vapor, and nitrogen containing gas (e.g., nitrogen gas) [col. 14], wherein the hydrogen-rich vapor is formed by having hydrogen and oxygen gases (at a ratio of 2:1) [col. 15] react each other in an external space **141** of the chamber **100** [Fig. 11 and col. 16, ln.34]

Tanabe et al definitely teaches using a nitrogen containing gas because *Tanabe et al* discloses using a purge gas made of an inert gas such as nitrogen [col. 14, ln.57].

Although *Tanabe et al* teaches nitridizing the gate electrode comprising metal layer **12** (called "light oxidation" by introducing nitrogen into the chamber having a hydrogen-rich vapor), *Tanabe et al* is silent about forming a metal nitride during the oxidation process. Nevertheless, such metal nitride formation by oxidation is notoriously well known in the art as seen by the plethora of *Rha et al* teaching that the nitrogen nitrifies the exposed surface of the W layer **44** to form a tungsten nitride **47** [col. 4].

It would have been obvious to one having ordinary skill in the art to have modified the process of *Tanabe et al* by specifying a metal nitride formation because a metal nitride is most likely formed when the nitrogen nitrifies the exposed metal (at which the oxidation is minimized).

b) In re claims 4 and 12, since *Tanabe et al* teaches a method for suppressing abnormal oxidation of W or WSi_x layer “only Si can be selectively oxidized without oxidizing the W film 12 and barrier WN film 11”, *Tanabe et al* indirectly suggests that the nitrogen permeates a metal oxide layer, decreases surface mobility of the metal oxide layer and prevents formation of nucleation cities of whiskers on the metal oxide layer. As noting, an oxide film being formed with the selective oxidation must have a dense film quality (compared to other oxide films formed by a conventional thermal oxidation), thereby improving electrical insulation. Consequently, whiskers or hillocks are less likely formed on the structure.

Furthermore, the functional recitation has not been given patentable weight because it is narrative in form. *In re Fuller*, 1929 C.D. 172; 388 O.G. 279.

Response to Arguments

4. The rejections under 35 USC § 112, second paragraph, are overcome after the term “non-inert nitrogen” has been deleted.

After a closer review of the applicant’s argument, dated 11/24/03, and after further search related arts, the examiner has found a new piece of art, US 6,197,702 to *Tanabe et al*, which would read on the applicant’s claims. Therefore, a new ground of rejections has been addressed above.

Contact Information

5. Any inquiry concerning this communication from the Examiner should be directed to *Calvin Lee* at 703-306-5854, Monday to Thursday, from 7 to 5 (ET). If attempts to reach the examiner by telephone are unsuccessful, Art Unit 2825's Supervisory Patent Examiner *Matthew Smith* whose telephone number is 703-308-1323.

Any inquiry relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0596. The fax phones are (703) 872-9318 for regular communications and (703) 872-9319 for After-Final communications.



Calvin Lee
Patent Examiner